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10/723,445	11/26/2003	Prabhu Krishnamoorthy	543.011US1	5969

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EXAMINER
BITAR, NANCY

ART UNIT	PAPER NUMBER
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12/09/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _04 September 2008_.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-21_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-21_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _01 July 2004_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _6/1/04, 6/15/05, 5/22/06, 9/4/06_.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____ .

DETAILED ACTION

Examiner Notes

1.   Examiner cites particular columns and line numbers in the references as applied to the

claims below for the convenience of the applicant. Although the specified citations are

representative of the teachings in the art and are applied to the specific limitations within the

individual claim, other passages and figures may apply as well. It is respectfully requested that,

in preparing responses, the applicant fully consider the references in entirety as potentially

teaching all or part of the claimed invention, as well as the context of the passage as taught by

the prior art or disclosed by the examiner.

Claim Rejections - 35 USC § 101

2.   35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or
> any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and
> requirements of this title.

Claim(s) 1-10, 12-20 are rejected under 35 U.S.C. 101 as not falling within one of the

four statutory categories of invention. While the claims recite a series of steps or acts to be

performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory

category (such as a particular apparatus), or (2) transform underlying subject matter (such as an

article or material) to a different state or thing (Reference the May 15, 2008 memorandum issued

by Deputy Commissioner for Patent Examining Policy, John J. Love, titled "Clarification of

'Processes' under 35 U.S.C. 101"). The instant claims neither transform underlying subject

matter nor positively tie to another statutory category that accomplishes the claimed method

steps, and therefore do not qualify as a statutory process.

NOTE: Regarding the rejection of claims 1-10,12-20, please see the Memorandum dated May 15, 2008, "Clarification of Processes under 35 USC § 101" which may be viewed at the following web address:

http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/section101_05_15_2008.pdf

Claim Rejections - 35 USC § 112

3.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 10 and 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation "displaying the segmented 3D tubular structure in a manner that mimics a conventional angiogram" is unclear and confusing what feature or limitation this language is intended to modify or further define. Therefore, claim 20 is indefinite and fails to clearly point out and distinctly define applicant's invention.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5.   **Claims 1-21** are rejected under **35 U.S.C. 103(a)** as being unpatentable over Johnson et

al (US 6,928,314) in view of Li et al (Combining Front Propagation with Shape Knowledge for

Accurate Curvilinear Modeling)

As to claim 1,   Johnson et al teaches a computer-assisted method comprising: accessing

stored volumetric (3D) imaging data of a subject (32, figure 2, note that Johnson et al teaches

provide diagnostic images of a <u>tubular</u> structure of a human body at a series of viewpoints along

the structure) ; representing at least a portion of the 3D imaging data on a two dimensional (2D)

screen (see figure 4; note that a graphical user interface (GUI) control panel 70 allows a user to

adjust the window and level settings) ; receiving user-input specifying a single location on the

2D screen (one approach to improve accuracy involves production of reformatted 2D images at

cross sections and orthogonal angles to the colon midline. These reformatted 2D images can

provide complimentary diagnostic information when viewed with corresponding intraluminal 3D

images. Exam efficiency can be improved with innovative 3D rendering techniques that allow

fast, interactive evaluation on low priced computer hardware, column 1, lines 65-column 2, lines

1-51) computing an initial centerline path of the tubular structure 9 column 9, lines 35-column 10

lines 67); obtaining segmented 3D tubular structure data by performing a segmentation that

separates the 3D tubular structure data from other data in the 3D imaging data using the single

location as an initial seed for performing the segmentation; . While X meets a number of the

limitations of the claimed invention, as pointed out more fully above, X fails to specifically teach

correcting the initial centerline path using the segmented 3D tubular structure data .Specifically,

Li et al. teaches an accurate curvilinear modeling uses *a priori* shape knowledge embedded in a

deformable model. In addition, it also embodies front propagation. We use a modified tubular

deformable model to implement the constraints. A distance field is first constructed and then uniformly thresholded to obtain suitable propagation channels. A propagation map is then constructed from a start point using FMM, and then backtracked when the end is reached to generate the Minimal Cost Path. At each point on the MCP, the original data is resampled in planes perpendicular to the local orientation of the MCP. A deformable tubular model is constructed inside the resampled data and allowed to deform so that it recovers the object of interest. Towards the end of the deformation, an adaptive deflation force replaces the original inflation force. Finally, the curvilinear model is obtained by extracting the spine of the tubular model and transforming it back into the coordinates of the original data it would have been obvious to one of ordinary skill in the art to correct the centerline path in Johnson in order ensures that rapid symmetric changes, such as a sharp turns, are not lessened while many asymmetric changes, such as a branching event or aneurysms, can be removed to a large extent. In addition, deforming the model in the transformed data domain vastly simplifies the computation, making it efficient. Therefore, the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention by applicant.

As to claim 2, Li et al teaches the method of claim 1, further comprising incrementally extracting from the 3D imaging data a central axis path of the tubular structure (The centerline is located by detecting optimal responses derived from Hessian matrices at a range of scales of interest. this class of algorithms produce good results but problems may occur at junctions or tangent vessels, page 67, 3rd paragraph)

As to claims 3 and 4, Li et al teaches the method of claim 2, in which the performing the segmentation further comprises: initializing a front at an origin that is located along the central

axis path; initializing a propagation speed of evolution of the front to a first value; propagating

the front by iteratively updating the front, the updating including recalculating the propagation

speed (We use a modified tubular deformable model to implement the constraints. A distance

field is first constructed and then uniformly thresholded to obtain suitable propagation channels.

A propagation map is then constructed from a start point using FMM, and then backtracked

when the end is reached to generate the Minimal Cost Path, section 3, page 68);comparing the

propagation speed to a predetermined threshold value that is less than the first value; if the

propagation speed falls below the predetermined threshold value, then terminating the

propagating of the front; and classifying all points that the front has reached as pertaining to the

tubular structure (section 3.2; note that the pre-processing is performed by first thresholding the

image, and then computing a distance map using a chamfer algorithm [11]. Once the end points

and are selected, a connected-component analysis is performed to determine the local peaks in

their neighborhoods in the distance map. The distance map is thresholded if the values at those

peaks exceed a target value; page 69)

As to claim 5, Li et al teaches the method of claim 1, further comprising: computing a

central vessel axis (CVA) of the segmented 3D tubular structure; representing a 3D image of a

region near the segmented 3D tubular on a two dimensional (2D) screen; displaying on the

screen a first lateral view of at least one portion of the segmented 3D tubular structure, the first

lateral view obtained by performing curved planar reformation on the CVA of the segmented 3D

tubular structure (section 3.2-3.3);displaying on the screen a second lateral view of the at least

one portion of the segmented 3D tubular structure, the second lateral view taken perpendicular to

the first lateral view; displaying on the screen cross sections,

perpendicular to the CVA (At each point on the MCP, the original data is resampled in planes

perpendicular to the local orientation of the MCP, page 68); and wherein the 3D image, the first

and second lateral views, and the cross sections are displayed in visual correspondence together

on the screen (see Li et al, figure 3, the carotids are visualized using Maximum Intensity

Projection (MIP), along with their ACMs).

As to claim 6, Li et al teaches the method of claim 1, further comprising masking data

that is outside of the 3D tubular structure (figure 2, and section 4, page 71).

As to claim 7, Li et al teaches the method of claim 1, further comprising computing at

least one estimated diameter of the segmented 3D tubular structure(figure 1, section 3.1, page

68-69; see also Johnson et al. (column 11, lines 30-59).

As to claim 8, Li et al. teaches the method of claim 7, further comprising flagging at least

one location of the segmented 3D tubular structure, the at least one location deemed to exhibit at

least one of a stenosis or an aneurysm (page 68, figure 1; vessel with eneurysm; vessel stenosis,

section 3.2 page 69).

As to claim 9, Johnson teaches the method of claim 7, further comprising displaying the

segmented 3D tubular structure using a color-coding to indicate the diameter (note that CTC

utilizes an interactive combination of axial, reformatted 2D and 3D images (from an endoluminal

perspective) that are generated in real time. Navigating the color within this "Virtual Endoscopy"

(VE) metaphor, figure 10).

As to claim 10, Li et al teaches the method of claim 1, further comprising displaying the

segmented 3D tubular structure in a manner that mimics a conventional angiogram (section 3.2).

The limitation of claim 11 had been addressed above in claim 1.

The limitation of claim 12 has been addressed in claim 4

The limitation of claims 13- 21 has been addressed above.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to NANCY BITAR whose telephone number is (571)270-1041.

The examiner can normally be reached on Mon-Fri (7:30a.m. to 5:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Jinge Wu can be reached on 571-272-7429. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would

like assistance from a USPTO Customer Service Representative or access to the automated

information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jingge Wu/
Supervisory Patent Examiner, Art Unit 2624

Nancy Bitar   12/6/2008